

(Cu), chromium (Cr), tantalum (Ta), vanadium (V), manganese (Mn), aluminum (Al), and silver (Ag).

24. (New) The light-emitting semiconductor device according to claim 22, wherein said material of said third metal layer includes at least one of aluminum (Al), nickel (Ni), and titanium (Ti).

25. (New) The light-emitting semiconductor device according to claim 22, wherein said protection film is made of silicon oxide ( $\text{SiO}_2$ ).

26. (New) The light-emitting semiconductor device according to claim 22, wherein said material of said first metal layer is nickel (Ni) and said material of said third metal layer is aluminum (Al).

#### REMARKS

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1, 2, 4-26 are pending in the application with 1, 12 and 15 being the independent claims. New claims 22-26 are sought to be added. These changes are believed to introduce no new matter, and their entry is respectfully requested. Unless otherwise stated, the amendments to claims are strictly for the purpose of improving the clarity thereof.

Based upon the above amendments and the following remarks, Applicants respectfully request that the Examiner withdraw all outstanding rejections of the above-identified application.

#### Personal Interview

Applicants wish to thank Examiner Douglas Willie for a constructive interview on December 8, 1999 with Applicants' representative. During the interview, Applicants

described the present invention and differences between the present invention and cited U.S. Patent No. 5,563,422 issued to Nakamura *et al.* (U.S. ‘422) and U.S. Patent No. 5,408,120 issued to Manabe *et al.* (U.S. ‘120). In particular, Applicants presented experimental data that helps to distinguish the claimed invention over U.S. ‘422. At the Examiner’s request, a color copy of the experimental data has been included with this response.

### Rejections under 35 U.S.C. § 102

In paragraphs 1 and 2 of the Office Action, claims 12-14 and 21 were rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by U.S. Patent No. 5,563,422 issued to Nakamura *et al.* (U.S. ‘422). This rejection is respectfully traversed.

For a reference to anticipate a claim, each element of the claim must be found, either expressly or under a principal of inherency, in that reference. Applicants respectfully submit that Nakamura *et al.* (U.S. ‘422) fails to disclose each element of the claimed invention. In particular, Nakamura *et al.* (U.S. ‘422) fails to disclose the following claimed limitation of claim 12:

“The portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that of said first electrode layer by heat treatment and provides a contact resistance between said electrode layer and said surface layer lower than that portion covered with said electrode pad.”

As discussed during the interview, the submitted experimental data helps to distinguish independent claim 12 over Nakamura *et al.* (U.S. ‘422). In particular, Nakamura discloses “it is preferred that the annealing treatment in the present invention be conducted under a non-oxidative or inert atmosphere, such as nitrogen.” (Col. 6, lines 5-7; emphasis added). In the experimental data submitted by applicants, the inverse distribution of nickel (Ni) and gold (Au) was examined under three conditions: a heating process with oxygen, illustrated by figures A-1, A-2L, and A-2S; a process of no heat treatment, illustrated in

figure A-3; and a heating process in a non-oxidative environment, illustrated by figures A-5 and A-5.

Analyzing the inverse distribution in the depth direction as illustrated in figures A-1, A-2L, and A-2S, nickel (Ni) and gold (Au) are inverted in the presence of heat and oxygen. When the heating process is not carried out, as illustrated in figure A-3, or when there is no oxygen (as in Nakamura *et al.*) in the atmosphere, as illustrated in figures A-4 and A-5, no transfer of nickel (Ni) and gold (Au) can be observed.

Nakamura fails to teach the inversion of the two elements in an oxidative atmosphere. However, in the present invention, "providing a heat treatment on the electrode layer causes the element of the first electrode layer to move to the surface of the second electrode layer" (See Specification @ page 7, lines 5-7). As such, claim 12 of the present invention is distinguished from Nakamura.

Applicants have shown how claim 12 patentably distinguishes Applicants' invention from Nakamura. Thus, claims 13, 14 and 21, which depend from claim 12, are patentably distinct from Nakamura for at least the same reasons as set forth above with respect to independent claim 12 of the present invention.

Reconsideration and withdrawal of the rejection is respectfully requested.

### Rejections under 35 U.S.C. § 103

In paragraph 5 of the Office Action, claims 1, 2, 4-11, and 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,563,422 issued to Nakamura *et al.* ('422) in view of U.S. Patent No. 5,408,120 issued to Manabe *et al.* ('120), and U.S. Patent No. 5,777,350 issued to Nakamura *et al.* ('350). Applicants respectfully traverse the rejections.

In order to establish a *prima facie* case of obviousness, all of the claimed limitations must be taught or suggested by the prior art, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings.

Applicants respectfully submit that neither Nakamura ('422), Manabe ('120), nor Nakamura ('350) taken alone nor in combination teach or suggest all of the claimed limitations of independent claim 1. In particular, the cited references fail to teach or suggest an electrode pad having a three layer structure, wherein the lowest layer (a first metal layer) is formed by a metal which has an ionization potential lower than gold (Au), and an upper layer (a third metal layer) formed of aluminum which has an adhesiveness to a protection film that is stronger than that of gold (Au).

In paragraph 6, the Office Action states that '422 shows a bonding pad 17 which is composed of nickel (Ni) and gold (Au), but concedes that Nakamura teaches against the use of Al in a two layer structure since it can migrate to the [p]-electrode and degrade it. The Office Action further states that it would be obvious to modify the '422 device to include an Al layer as taught by '120 which discloses a multi-layer electrode structure (*See* Figure 6 and col. 5, line 38). Applicants respectfully note that the electrode 70 and Figures 6-7 of Manabe is an electrode layer, not an electrode pad as required by the claimed invention. As such, Manabe ('120) discloses a multi-layer electrode made up of nickel and aluminum, but fails to disclose an electrode pad as defined by the specification and claims of the present invention. In addition, Manabe fails to disclose a protective film that covers a third metal layer (an Al layer) which has an adhesiveness to the protection film that is stronger than gold (Au).

Since Manabe describes an electrode layer, not an electrode pad, one of ordinary skill in the art would clearly not have been motivated [from the teachings of Manabe ('120)] to modify the electrode pad of Nakamura ('422 and '350) to provide the claimed three layer

structure electrode pad. Moreover, including an aluminum (Al) layer, as taught by Manabe, into the structure of Nakamura would clearly contradict the teachings of Nakamura, which as indicated in the above discussion and Col. 7, lines 13-15 of '422, teach against the use of aluminum.

Accordingly, Applicants respectfully submit that independent claim 1 is patentable over Nakamura ('422), Manabe ('120) and Nakamura ('350). Claims 2, 4-11, and 20 depend from claim 1. Applicants have shown how claim 1 is patentably distinct from the cited references. Thus, claims 2, 4-11, and 20 are patentably distinct from the cited references for at least the same reasons set forth above and further in view of their own respective features.

Reconsideration and withdrawal of the rejection of claims 1, 2, 4-11 and 20 are respectfully requested.

### New Claims

New claims 22-26 have been added to provide additional protection for what Applicants believe to be the invention. Since claims 22-26 depend from claim 12, Applicants believe that these claims are allowable for the same reasons noted above.

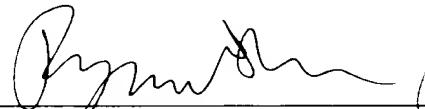
### Conclusion

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

Intellectual Property Group of  
PILLSBURY MADISON & SUTRO LLP

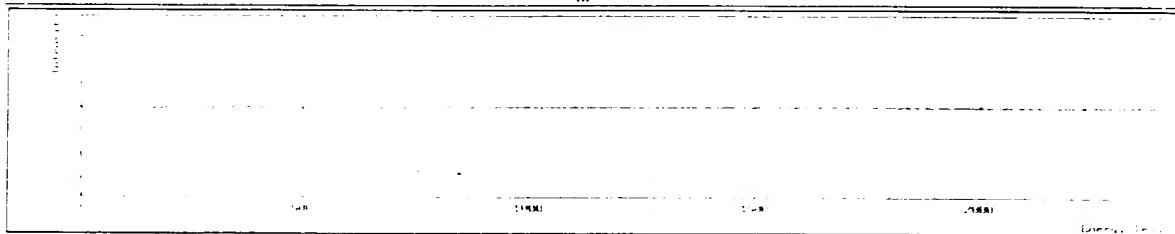
By:  (41426)  
*fr* Peter W. Gowdey  
Reg. No. 25872  
Tel. (202) 861-3078

PWG/VPH:ksh

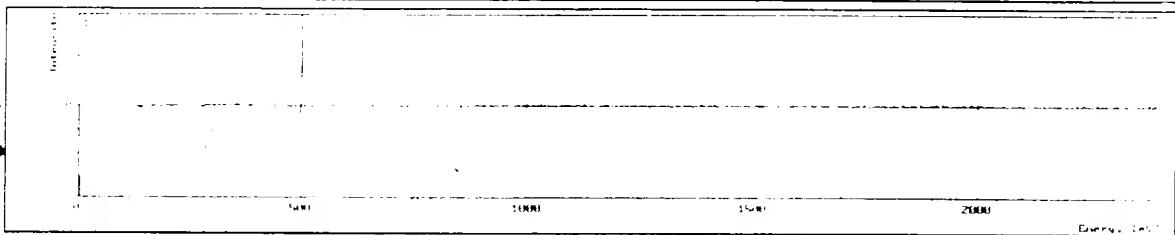
NINTH FLOOR  
1100 NEW YORK AVENUE, N.W.  
WASHINGTON, D.C. 20005-3918  
Fax (202) 822-0944

4/5

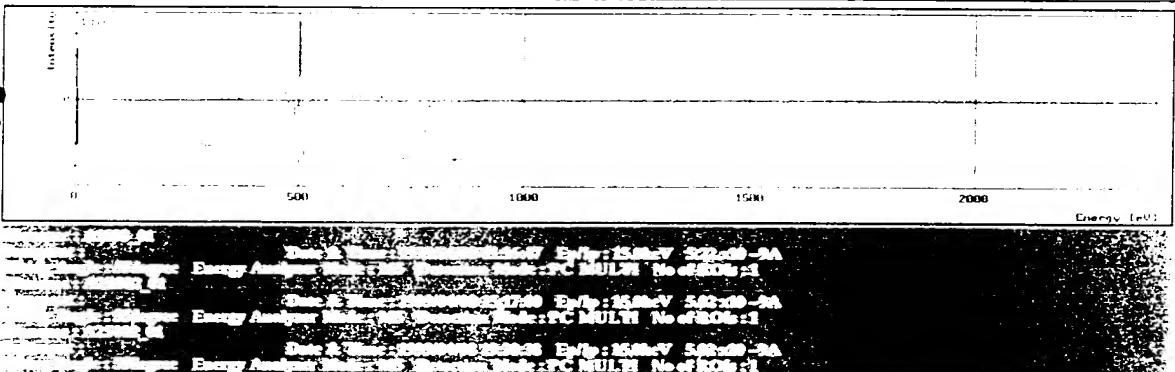
A-1



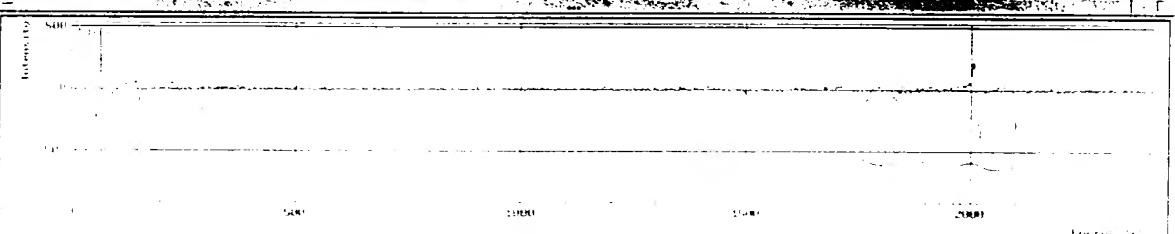
A-2L



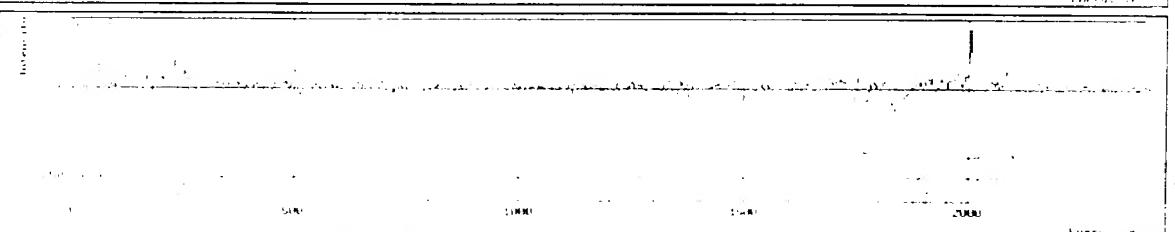
A-2S



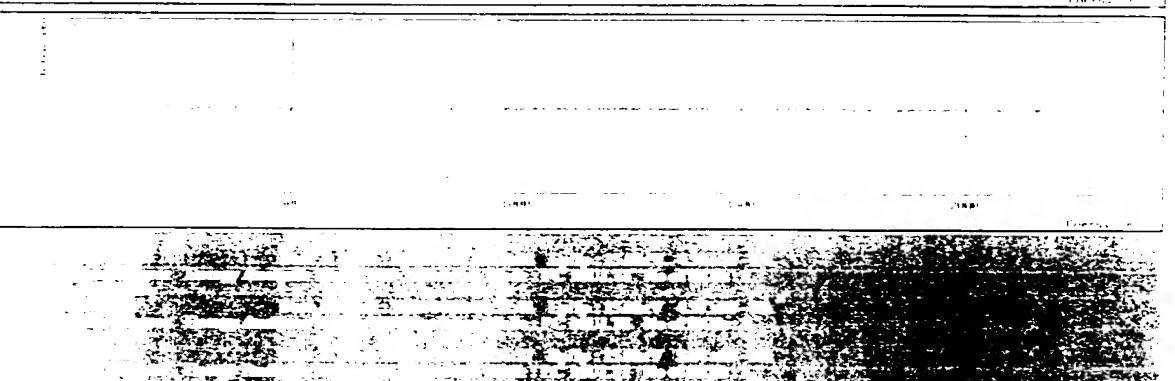
A-3



A-4



A-5



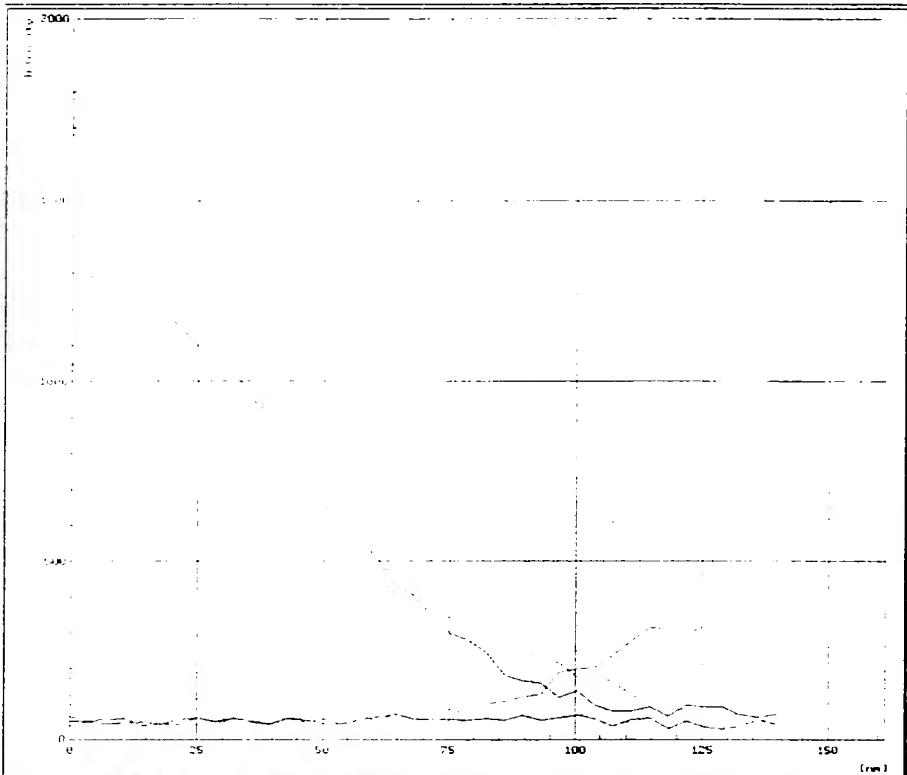
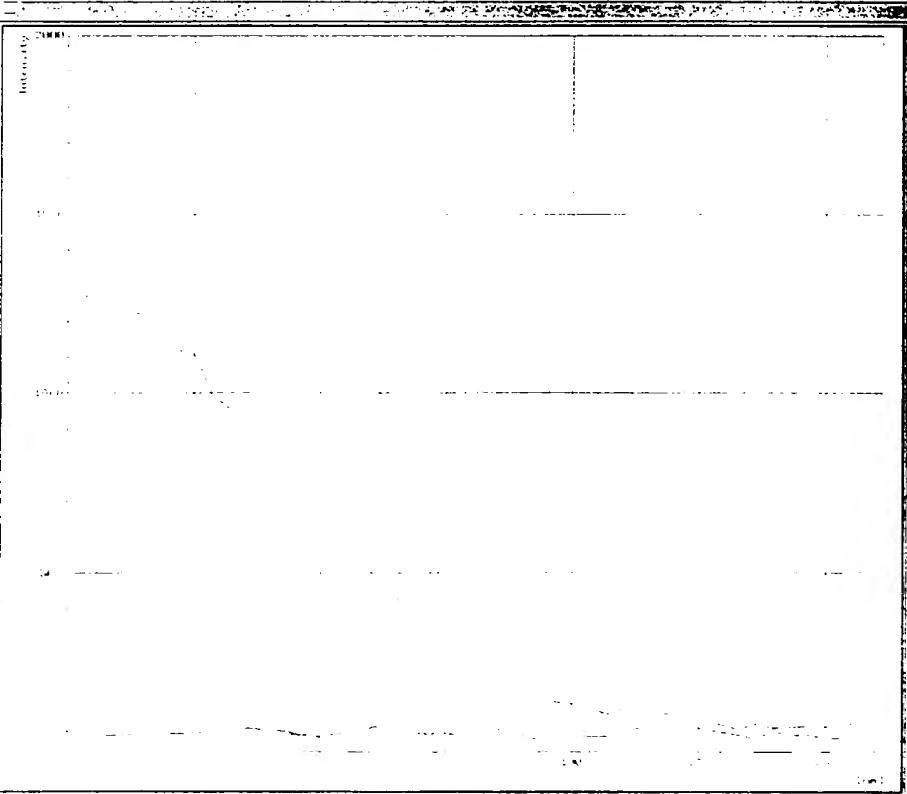
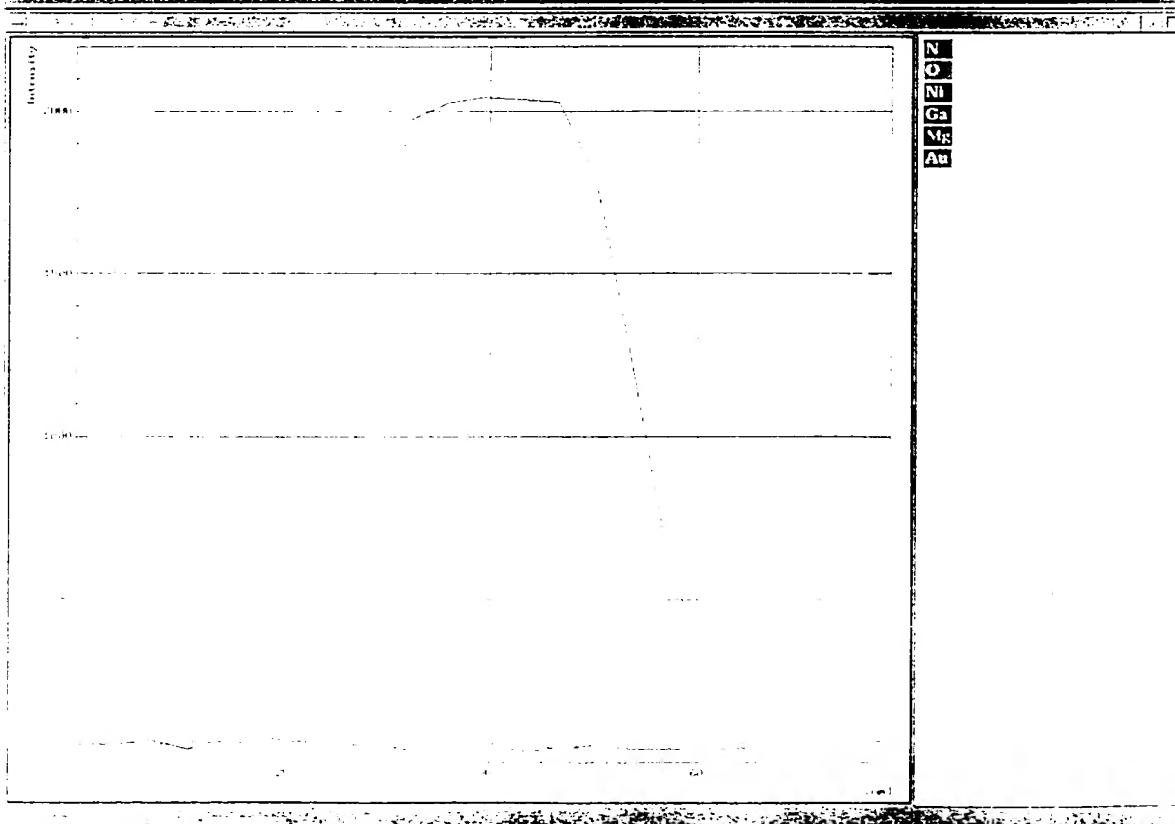
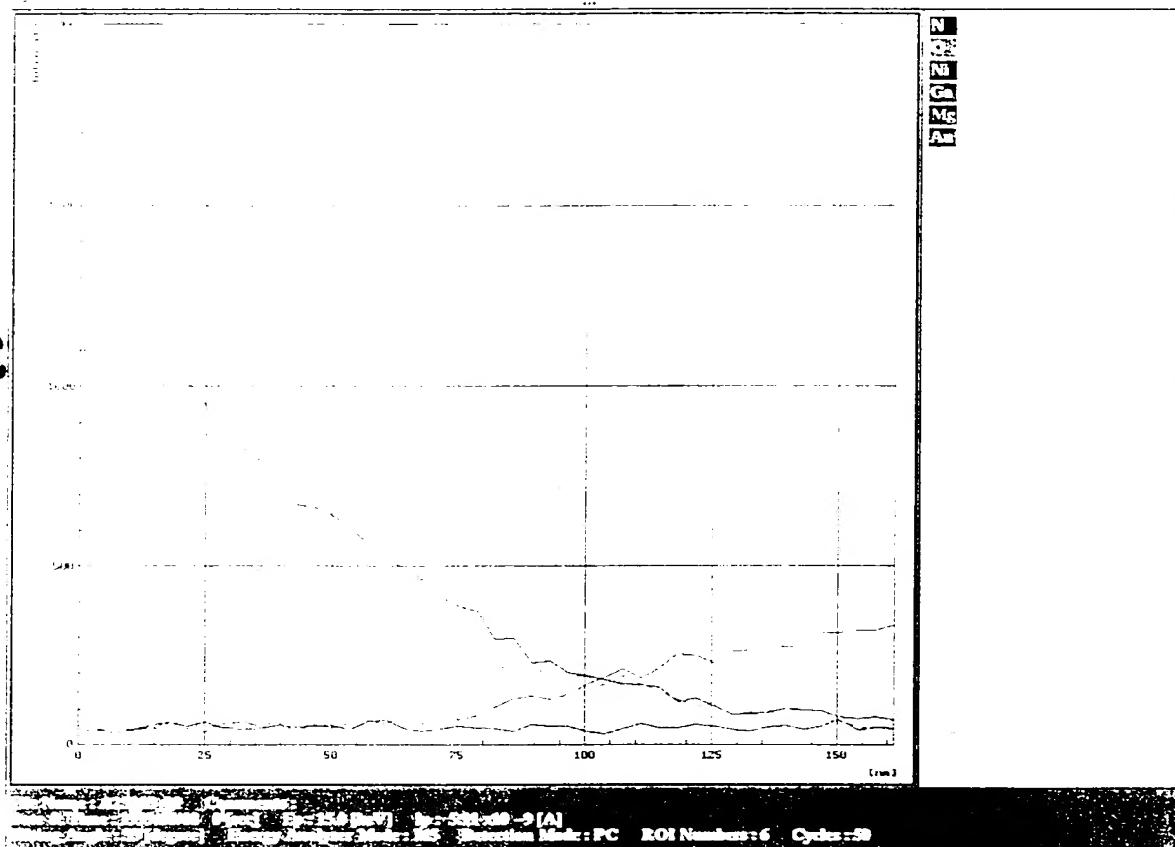


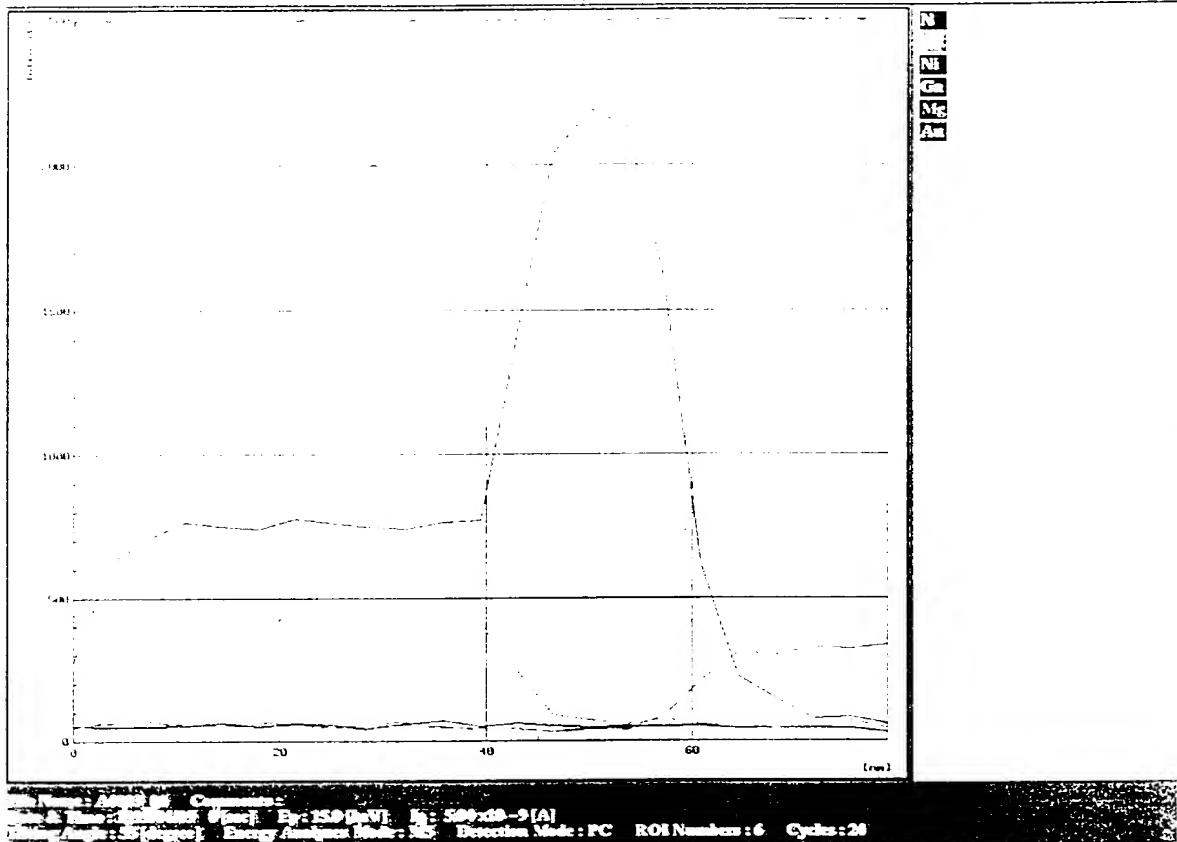
Image Size : 512 x 512 [A]      Resolution : MS      Detection Mode : PC      ROI Number : 6      Cycles : 40



A-21



A-4



Instrument: EDS  
Software Version: By: ISD (DWL)  
Sc: 500x50-3 [A]  
E: 15 [eV]  
Detection Mode: PC ROI Number: 6 Cycles: 24

A-5r

